Corrective Measures Study Report
Boeing Plant 2

Remediation Area Alternative Cost Summary

Remediation Area	Alternative Number	Alternative Title	Estimated Cost	Estimated Cost[1]
RA 1	1	Corrective Action Not Required (with Controls)	$36,260	$36,000
	2	Enhanced Reductive Dechlorination	$304,410	$304,000
	2a	Enhanced Reductive Dechlorination with Excavation	$379,880	$380,000
RA 2	1	Corrective Action Not Required (with Controls)	$36,260	$36,000
	2	Enhanced Reductive Dechlorination	$304,410	$304,000
	2a	Enhanced Reductive Dechlorination with Excavation	$337,860	$338,000
RA 3	1	Corrective Action Not Required (with Controls)	$45,830	$46,000
	2	Enhanced Reductive Dechlorination	$311,452	$311,000
	3	Air Sparging/SVE	$609,152	$609,000
RA 4	1	Corrective Action Not Required (with Controls)	$78,320	$78,000
	2	Enhanced Reductive Dechlorination	$542,387	$542,000
	2a	Enhanced Reductive Dechlorination with Excavation	$741,081	$741,000
	3	Air Sparging/SVE	$879,792	$880,000
	3a	Air Sparging/SVE with Excavation	$1,078,486	$1,078,000
RA 5	1	Corrective Action Not Required (with Controls)	$115,280	$115,000
	2	Enhanced Reductive Dechlorination	$570,500	$571,000
	2a	Enhanced Reductive Dechlorination with Excavation	$670,104	$670,000
	2b	Enhanced Reductive Dechlorination, Enhanced Aerobic Degradation	$691,010	$691,000
	2c	Enhanced Reductive Dechlorination, Enhanced Aerobic Degradation with Excavation	$790,614	$791,000
RA 6	1	Corrective Action Not Required (with Controls)	$47,830	$48,000
	2	Excavation to FMCLs	$1,122,814	$1,123,000
RA 7	1	Corrective Action Not Required (with Controls)	$47,830	$48,000
	2	Bioventing to FMCLs	#REF!	#REF!
	3	Excavation to FMCLs	$100,721	$101,000
RA 8	1	Corrective Action Not Required (with Controls)	NA	NA
	2	Excavation to FMCLs	$240,128	$240,000
RA 9	1	Corrective Action Not Required (with Controls and Monitoring)	$29,010	$29,000

Note: NA - All RA 8 monitoring cost are covered by other RAs.

[1]Rounded to the nearest thousand.

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RA 1 and RA 2 2-10 North and South Sheetpile Long Term Monitoring Estimated Costs for CMS

(Due to the similarity between RA 1 and RA 2 estimated costs apply to both RA 1 and RA2 individually)

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$1,932	$9,660	2 shoreline wells
Overnight shipping to subcontract labs	5	per year	$60	$300	
Labor (5 years)	40	hours	$120	$4,800	assume two people for four hours each semiannual event
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$75	$750	2 events per year for 5 years
				$15,510	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments - Assume 5 years					
Labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	50	hours	$175	$8,750	reporting costs assumed to be approx 15% of total shoreline reporting costs
	100	hours	$120	$12,000	
				$20,750	Subtotal

Estimated Total	**$36,260**

SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs	6	ea	$162	$972	Semiannual sampling in 3 wells
PP metals	6	ea	$160	$960	
				$1,932	Total

RA 1 and RA 2 2-10 North and South Sheetpile ERD Estimated Costs for CMS

(Due to the similarity between RA 1 and RA 2 estimated costs apply to both RA 1 and RA2 individually)

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Initial Sampling - not needed, data are current					
Work Plan preparation	0	lump sum	$10,000	$0	
Utility locate	0	lump sum	$800	$0	
Probe rig (per day)	0	days	$3,500	$0	Plume area is approx. 400x400, three transects with 50-ft spacing for a total of 20-24 points. 7-8 sampling points per day, three days probing.
Field oversight labor	0	hours	$120	$0	three 10-hour days with 2 hours travel time
Analytical tests (cVOCs)	0	each	$162	$0	
Expenses (equipment, truck, tubing, filters, meters)	0	lump sum	$400	$0	
				$0	Subtotal

Remedial Action Planning					
Prepare remediation work plan (includes results from initial sampling)	1	lump sum	$8,500	$8,500	Simpler work plan based on existing Calibre plan
Time to assemble equipment/supplies	40	hours	$120	$4,800	
				$13,300	Subtotal

Injection Well Installation - Already installed					
Utility locate	0	each	$800	$0	
Labor for utility locate oversight	0	hours	$120	$0	
Drilling Contractor	0	per well	$3,200	$0	Wells already installed
Vac truck to clear holes prior to drilling	0	locations	$600	$0	$600 per location
Labor for drilling oversight	0	hours	$120	$0	Wells already installed
Labor for well development	0	hours	$120	$0	Wells already installed
Well development equipment	0	each	$150	$0	Wells already installed
				$0	Subtotal

Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$12,272	$61,360	13 wells
Overnight shipping to subcontract labs	5	per year	$150	$750	

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RA 1 and RA 2 2-10 North and South Sheetpile ERD Estimated Costs for CMS
(Due to the similarity between RA 1 and RA 2 estimated costs apply to both RA 1 and RA2 individually)

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Labor (5 years)	450	hours	$120	$54,000	assume two people for two 10-hour days each semiannual event, mob and demob and travel time.
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$400	$4,000	2 events per year for 5 years
				$120,110	Subtotal

Injection - follow up (assume one injection event per year for 5 years)					
Injection equipment	1	lump sum	$1,500	$1,500	
Labor planning	80	hours	$175	$14,000	16 hours per event for 5 events
Labor - injection (assume one person)	250	hours	$120	$30,000	50 hours per year for 5 years including travel time
Sugar	50000	pounds	$0.85	$42,500	10,000 pounds per year for 5 years
				$88,000	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments - Assume 5 years					
Labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	200	hours	$175	$35,000	40 hours per year for 5 years
	400	hours	$120	$48,000	80 hours per year for 5 years
				$83,000	Subtotal

Estimated Total	**$304,410**

RA 1 and RA 2 2-10 North and South Sheetpile ERD Estimated Costs for CMS

(Due to the similarity between RA 1 and RA 2 estimated costs apply to both RA 1 and RA2 individually)

Item	Quantity	Unit	Cost per Unit	Cost	Notes
SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs	26	ea	$162	$4,212	Semiannual sampling in 13 wells
TOC	26	ea	$60	$1,560	
D. Gases	10	ea	$100	$1,000	Sample only the 5 downgradient wells twice per year.
Ferrous iron	10	ea	$40	$400	
Anions	10	ea	$60	$600	
O. acids	10	ea	$140	$1,400	
PP metals	10	ea	$160	$1,600	
Bacterial census	5	ea	$300	$1,500	Sample only the 5 downgradient wells once per year.
				$12,272	Total

RA 1 2-10 North Sheetpile Estimated Costs for Soil Excavation to FMCLs and Leaching SLs

Locations	**L**	**W**	**D**	**LF**	**SF**	**CF**	**CY**	**TONS**
SWMU 2-10.3A (3 exceedance locations)	40	10	10	100	400	4,000	150	217.50

Item	**Qty**	**Cost per Unit**	**2014 Cost**	**2017 Cost**
Mobilization/Demobilization (ls)	1	$ 4,000	$ 4,000	$ 4,172
Concrete cutting (lf)	100	$ 5	$ 500	$ 522
Concrete removal (sf)	400	$ 2.50	$ 1,000	$ 1,043
Concrete disposal (ton)	19	$ 125	$ 2,417	$ 2,521
Soil excavation (cy)	150	$ 4	$ 600	$ 626
Testing (ls)	18	$ 850	$ 15,300	$ 15,958
Soil disposal (ton)	218	$ 75.50	$ 16,421	$ 17,127
Backfill hauling (ton)	218	$ 15	$ 3,263	$ 3,403
Backfill placement (cy)	150	$ 4	$ 600	$ 626
Pavement replacement (sf)	400	$ 4	$ 1,600	$ 1,669
Monitoring (ls)	3.5	$ 1,200	$ 4,200	$ 4,381
Report (ls)	3	$ 1,920	$ 5,760	$ 6,008
Subtotal			$ 55,660	$ 58,054
Contingency (30%)			$ 16,698	$ 17,416
Total			**$ 72,359**	**$ 75,470**
		tons:	**218**	**215**
		$/ton:	**$ 333**	**$ 351**

	Costs	**Contingency**	**Total**
Consultant	$ 10,388	$ 3,116	$ 13,505
Contractor	$ 31,708	$ 9,512	$ 41,220
Laboratory	$ 15,958	$ 4,787	$ 20,745
Total	**$ 58,054**	**$ 17,416**	**$ 75,470**

Estimated Total for Excavation to FMCLs

$ 132,450

(260 cy) excavation to leaching SLs @ $351 per ton

Assumptions:

2. Soil disposal assumes CID rate of $75.50/ton.
3. Monitoring includes 4 days of monitoring: 0.5 day preparation, 2 days excavation, and 1 day backfill.
4. Report consists of 3 reports: work plan, sampling plan, and completion report.
5. Monitoring labor is $120/hour for field engineer/scientist.
6. Each exceedance of the FMCL (or leaching SL) is representative of a 10 ft x 10 ft x 10 ft excavation.
7. Excavation quantity is 150 cy to direct contact cleanup levels and an additional 260 cy for excavation to leaching screening levels.
8. Total Cost reflects cost adjusted for inflation between October 2014 (draft CMS) and November 2017 (final CMS).

RA 2 2-10 South Sheetpile Estimated Costs for Soil Excavation to FMCLs and Leaching SLs

Locations	**L**	**W**	**D**	**LF**	**SF**	**CF**	**CY**	**TONS**
SWMU 2-10.4A (1 exceedance locations)	10	10	10	40	100	1,000	40	58.00

Item	**Qty**	**Cost per Unit**	**Cost**	
Mobilization/Demobilization (ls)	0	$ 4,000	$ -	$ -
Concrete cutting (lf)	40	$ 5	$ 200	$ 209
Concrete removal (sf)	100	$ 2.50	$ 250	$ 261
Concrete disposal (ton)	5	$ 125	$ 604	$ 630
Soil excavation (cy)	40	$ 4	$ 160	$ 167
Testing (ls)	11	$ 850	$ 9,350	$ 9,752
Soil disposal (ton)	58	$ 77.86	$ 4,516	$ 4,710
Backfill hauling (ton)	58	$ 15	$ 870	$ 907
Backfill placement (cy)	40	$ 4	$ 160	$ 167
Pavement replacement (sf)	100	$ 4	$ 400	$ 417
Monitoring (ls)	2	$ 1,200	$ 2,400	$ 2,503
Report (ls)	3	$ 1,920	$ 5,760	$ 6,008
Subtotal			$ 24,670	$ 25,731
Contingency (30%)			$ 7,401	$ 7,719
Total			**$ 32,071**	**$ 33,450**
		tons:	**58**	**54**
		$/ton:	**$ 553**	**$ 623**

	Costs	**Contingency**	**Total**	
Consultant	$ 8,511	$ 2,553	$ 11,064	
Contractor	$ 7,468	$ 2,240	$ 9,708	
Laboratory	$ 9,752	$ 2,926	$ 12,678	
Total	**$ 25,731**	**$ 7,719**	**$ 33,450**	**Estimated Total for Excavation to FMCLs**

$ 163,015	**Cost for additional (320 cy) excavation to leaching SLs @ $351 per ton for RA 1**

Assumptions:

1. Testing includes 11 samples: 4 sidewall, 3 bottom, 3 stockpile, and 1 QA/QC samples.
2. Soil disposal assumes CID rate of $77.86/ton.
3. Monitoring includes 3 days of monitoring: 0.5 day preparation, 1 day excavation, and 0.5 days backfill.
4. Report consists of 3 reports: work plan, sampling plan, and completion report.
5. Monitoring labor is $120/hour for field engineer/scientist.
6. Each exceedance of the FMCL (or leaching SL) is representative of a 10 ft. x 10 ft. x 10ft excavation.
7. Excavation quantity is 40 cy to direct contact cleanup levels and an additional 320 cy for excavation to leaching SL.
8. Total Cost reflects cost adjusted for inflation between October 2014 (draft CMS) and November 2017 (final CMS).

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RA 3 2-31 Area Long Term Monitoring Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$2,776	$13,880	4 shoreline wells
Overnight shipping to subcontract labs	10	each	$100	$1,000	
EPI labor (5 years)	80	hours	$120	$9,600	assume two people for four hours each semiannual event
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$125	$1,250	Two events per year for five years
				$25,730	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
EPI labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	60	hours	$175	$10,500	6 hours per semiannual event for 5 years
	80	hours	$120	$9,600	8 hours per semiannual event for 5 years
				$20,100	Subtotal

Estimated Total	**$45,830**

SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs	8	ea	$162	$1,296	Semiannual sampling in four wells
PCBs	2	ea	$100	$200	Annual Sampling in two shoreline wells
PP metals	8	ea	$160	$1,280	Semiannual sampling in four wells
				$2,776	Total

RA 3 2-31 ERD Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Initial Sampling					
Work Plan preparation	1	lump sum	$10,000	$10,000	
Utility locate	1	lump sum	$800	$800	
Probe rig (per day)	2	days	$3,500	$7,000	Plume area is approx 200x300, three transects with 50-ft spacing for a total of 14-16 points. 7-8 sampling points per day, two days probing.
EPI field oversight labor	24	hours	$120	$2,880	two 10-hour days with 2 hours travel time
Analytical tests (cVOCs)	16	each	$162	$2,592	
Expenses (equipment, truck, tubing, filters, meters)	1	lump sum	$400	$400	
				$23,672	Subtotal

Remedial Action Planning					
Prepare remediation work plan (includes results from initial sampling)	1	lump sum	$15,000	$15,000	
Labor to assemble equipment/supplies	40	hours	$120	$4,800	
				$19,800	Subtotal

Injection Well Installation					
Utility locate	1	each	$600	$600	
Labor for utility locate oversight	8	hours	$120	$960	
Drilling Contractor	9	per well	$3,200	$28,800	Assume 6 4-inch injection wells drilled to 25 ft. bgs and 3 additional 2-inch monitoring wells to 25 ft.
Vac truck to clear holes prior to drilling	9	locations	$600	$5,400	$600 per location
Labor for drilling oversight	45	hours	$120	$5,400	4 hours per well for 9 wells plus travel time
Labor for well development	45	hours	$120	$5,400	4 hours per well for 9 wells plus travel time
Well development equipment	9	each	$150	$1,350	submersible pumps
				$47,910	Subtotal

Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$6,564	$32,820	See supporting calcs below
Overnight shipping to subcontract labs	5	per year	$150	$750	
EPI labor (5 years)	225	hours	$120	$27,000	assume two people for one 10-hour day each semiannual event, mob and demob and travel time.
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$300	$3,000	2 events per year for 5 years
				$63,570	Subtotal

RA 3 2-31 ERD Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Injection - follow-up (assume one injection event per year for 5 years)					
Injection equipment	1	lump sum	$1,500	$1,500	
Labor planning	80	hours	$175	$14,000	16 hours per event for 5 events
Labor - injection (assume one person)	200	hours	$120	$24,000	40 hours per year for 5 years including travel time
Sugar	40000	pounds	$0.85	$34,000	8,000 pounds per year for 5 years
				$73,500	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
Labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	200	hours	$175	$35,000	40 hours per year for 5 years
	400	hours	$120	$48,000	80 hours per year for 5 years
				$83,000	Subtotal

Estimated Total $311,452

SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs	12	ea	$162	$1,944	One event per year sampling all 9 wells, one event per year sampling only the 3 downgradient wells.
TOC	12	ea	$60	$720	
D. Gases	6	ea	$100	$600	Sample only the 3 downgradient wells twice per year.
Ferrous iron	6	ea	$40	$240	
Anions	6	ea	$60	$360	
O. acids	6	ea	$140	$840	
PP metals	6	ea	$160	$960	
Bacterial census	3	ea	$300	$900	Sample only the 3 downgradient wells once per year.
				$6,564	Total

RA 3 2-31 Area AS/SVE Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Initial Sampling					
Work Plan preparation	1	lump sum	$10,000	$10,000	
Utility locate	1	lump sum	$800	$800	
Probe rig (per day)	2	days	$3,500	$7,000	Plume area is approx 200x300, three transects with 50-ft spacing for a total of 14-16 points. 7-8 sampling points per day, two days probing.
Field oversight labor	24	hours	$120	$2,880	two 10-hour days with 2 hours travel time
Analytical tests (cVOCs)	16	each	$162	$2,592	
Expenses (equipment, truck, tubing, filters, meters)	1	lump sum	$400	$400	
				$23,672	Subtotal

Remedial Action Planning					
Prepare remediation work plan (includes results from initial sampling)	1	lump sum	$25,000	$25,000	Work plan is more difficult than for ERD due to mechanical systems and off gas treatment.
Labor to assemble equipment/supplies	80	hours	$120	$9,600	More equipment needed relative to ERD
				$34,600	Subtotal

AS/SVE Well Installation					
Utility locate	1	each	$600	$600	
Labor for utility locate oversight	10	hours	$120	$1,200	
Drilling Contractor	18	per well	$2,500	$45,000	Assume 5 2-inch AS wells drilled to 25 ft. bgs, 10 2-inch SVE wells to 8 ft. bgs, and 3 2-inch monitoring wells to 25 ft. bgs
Vac truck to clear holes prior to drilling	18	locations	$600	$10,800	$600 per location
Labor for drilling oversight	86	hours	$120	$10,320	4 hours per well for 16 wells plus travel time
Labor for well development	40	hours	$120	$4,800	4 hours per well for 8 wells plus travel time
Well development equipment	8	each	$150	$1,200	submersible pumps fore ach AS and monitoring well, none for SVE wells.
				$73,920	Subtotal

AS/SVE Equipment and Installation Costs					
AS Equipment Trailer Rental	60	per month	$1,200	$72,000	
SVE Equipment Trailer Rental	60	per month	$1,200	$72,000	
AS/SVE Piping and trenching	1	lump sum	$12,000	$12,000	
Electrician	1	lump sum	$3,500	$3,500	No power immediately at the location.
IDW waste disposal	1	lump sum	$7,000	$7,000	based on Calibre costs for 2-10 IM
PSCAA Permit	1	lump sum	$3,500	$3,500	Labor and permit costs
				$0	
				$170,000	Subtotal

RA 3 2-31 Area AS/SVE Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$8,382	$41,910	
Overnight shipping to subcontract labs	5	per year	$150	$750	
Labor (5 years)	450	hours	$120	$54,000	assume two people for two 10-hour days each semiannual event, mob and demob and travel time.
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$400	$4,000	2 events per year for 5 years
				$100,660	Subtotal

Power, O&M, Carbon Replacement					
Power	60	per month	$620	$37,200	based on Calibre cost of $612 per month to run two SVE trailers
O&M labor	480	hours	$120	$57,600	based on 8 hours per month for 60 months
ODCs	5	per year	$1,200	$6,000	based on Calibre ODC of $100/month for SVE systems
Carbon change out	5	Per event	$4,500.00	$22,500	Based on 2-66 DDC IM carbon change out, assume 1 change per year
				$123,300	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
Labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	200	hours	$175	$35,000	40 hours per year for 5 years
	400	hours	$120	$48,000	80 hours per year for 5 years
				$83,000	Subtotal

Estimated Total $609,152

RA 3 2-31 Area AS/SVE Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs in Groundwater	11	ea	$162	$1,782	One event per year sampling 5 AS wells and 3 monitoring wells, one event per year sampling only the 3 downgradient wells.
VOC in air by TO-15	22	ea	$300	$6,600	sample vapor at 10 SVE wells and after the carbon each semiannual event
TOC	0	ea	$60	$0	
D. Gases	0	ea	$100	$0	
Ferrous iron	0	ea	$40	$0	
Anions	0	ea	$60	$0	
O. acids	0	ea	$140	$0	
PP metals	0	ea	$160	$0	
Bacterial census	0	ea	$300	$0	
				$8,382	Total

RA 4 2-66 Sheetpile Adaptive Management Low Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$3,964	$19,820	6 shoreline wells
Overnight shipping to subcontract labs	10	per year	$60	$600	
EPI labor (5 years)	120	hours	$120	$14,400	assume two people for six hours each semiannual event
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$200	$2,000	Two events per year for five years
				$36,820	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
EPI labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of quarterly reports.	100	hours	$175	$17,500	10 hours per semiannual event for 5 years
	200	hours	$120	$24,000	16 hours per semiannual event for 5 years
				$41,500	Subtotal

Estimated Total	**$78,320**

SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs	12	ea	$162	$1,944	Semiannual sampling in 6 shoreline wells
PP metals	12	ea	$160	$1,920	
PCBs	1	ea	$100	$100	Annual Sampling in 1 shoreline well
				$3,964	Total

RA 4 2-66 Sheetpile ERD Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Initial Sampling					
Work Plan preparation	1	lump sum	$10,000	$10,000	
Utility locate	1	lump sum	$800	$800	
Probe rig (per day)	5	days	$3,500	$17,500	Plume area is approx 400x600, three transects with 50-ft spacing for a total of 36 points. 7-8 sampling points per day, five days probing.
Field oversight labor	60	hours	$120	$7,200	Five10-hour days with 2 hours travel time
Analytical tests (cVOCs)	36	each	$162	$5,832	A-Level only, VOCs only
Expenses (equipment, truck, tubing, filters, meters)	1	lump sum	$1,050	$1,050	
				$42,382	Subtotal

Remedial Action Planning					
Prepare remediation work plan (includes results from initial sampling)	1	lump sum	$25,000	$25,000	
Labor to assemble equipment/supplies	80	hours	$120	$9,600	
				$34,600	Subtotal

Injection Well Installation					
Utility locate	1	each	$800	$800	
Labor for utility locate oversight	10	hours	$120	$1,200	
Drilling Contractor	15	per well	$3,200	$48,000	Assume 15 4-inch injection wells drilled to 25 ft. bgs
Vac truck to clear holes prior to drilling	15	locations	$600	$9,000	$600 per location
Labor for drilling oversight	72	hours	$120	$8,640	4 hours per well for 15 wells plus travel time
Labor for well development	72	hours	$120	$8,640	4 hours per well for 15 wells plus travel time
Well development equipment	15	each	$180	$2,700	submersible pumps
				$78,980	Subtotal

Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$14,460	$72,300	15 injection wells. 6 shoreline wells
Overnight shipping to subcontract labs	5	per year	$150	$750	
Labor (5 years)	400	hours	$120	$48,000	assume two people for three 10-hour days each semiannual event, mob and demob and travel time.
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$600	$6,000	2 events per year for 5 years
				$127,050	Subtotal

RA 4 2-66 Sheetpile ERD Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Injection - followup (assume one injection event per year for 5 years)					
Injection equipment	1	lump sum	$3,500	$3,500	More equipment due to more injection wells
Labor planning	100	hours	$175	$17,500	20 hours per year for 5 years
Labor - injection (assume one person)	375	hours	$120	$45,000	75 hours per year for 5 years including travel time
Sugar	112,500	pounds	$0.85	$95,625	22,500 pounds per year for 5 years
				$161,625	Subtotal
Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
Labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	250	hours	$175	$43,750	50 hours per year for 5 years
	450	hours	$120	$54,000	90 hours per year for 5 years
				$97,750	Subtotal

Estimated Total $542,387

SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs	30	ea	$162	$4,860	One event per year sampling all 21 wells, one event per year sampling only the 6 downgradient wells.
TOC	30	ea	$60	$1,800	
D. Gases	12	ea	$100	$1,200	Sample only the 6 downgradient wells twice per year.
Ferrous iron	12	ea	$40	$480	
Anions	12	ea	$60	$720	
O. acids	12	ea	$140	$1,680	
PP metals	12	ea	$160	$1,920	
Bacterial census	6	ea	$300	$1,800	Sample only the 6 downgradient wells once per year.
				$14,460	Total

RA 4 2-66 Sheetpile AS/SVE Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Initial Sampling					
Work Plan preparation	1	lump sum	$10,000	$10,000	
Utility locate	1	lump sum	$800	$800	
Probe rig (per day)	5	days	$3,500	$17,500	Plume area is approx 400x600, three transects with 50-ft spacing for a total of 36 points. 7-8 sampling points per day, five days probing.
Field oversight labor	60	hours	$120	$7,200	Five10-hour days with 2 hours travel time
Analytical tests (cVOCs)	36	each	$162	$5,832	A-Level only, VOCs only
Expenses (equipment, truck, tubing, filters, meters)	1	lump sum	$1,050	$1,050	
				$42,382	Subtotal

Remedial Action Planning					
Prepare remediation work plan (includes results from initial sampling)	1	lump sum	$35,000	$35,000	Work plan is more difficult than for ERD due to mechanical systems and offgas treatment.
Labor to assemble equipment/supplies	160	hours	$120	$19,200	
				$54,200	Subtotal

AS Well Installation					
Utility locate	1	each	$800	$800	
Labor for utility locate oversight	10	hours	$120	$1,200	
Drilling Contractor	30	per well	$3,200	$96,000	Assume 10 2-inch AS wells drilled to 25 ft. bgs and 20 shallow SVE wells
Vac truck to clear holes prior to drilling	30	locations	$600	$18,000	$600 per location
Labor for drilling oversight	150	hours	$120	$18,000	4 hours per well for 30 wells plus travel time
Labor for well development	150	hours	$120	$18,000	4 hours per well for 30 wells plus travel time
Well development equipment	10	each	$180	$1,800	submersible pumps and tubing
				$153,800	Subtotal

AS/SVE Equipment and Installation Costs					
AS Equipment Trailer Rental	60	per month	$1,200	$72,000	
SVE Equipment Trailer Rental	60	per month	$1,200	$72,000	
AS/SVE Piping and trenching	1	lump sum	$18,000	$18,000	
Electrician	1	lump sum	$5,500	$5,500	No power immediately at the location.
IDW waste disposal	1	lump sum	$7,500	$7,500	based on Calibre costs for 2-10 IM
PSCAA Permit	1	lump sum	$4,500	$4,500	Labor and permit costs
				$179,500	Subtotal

RA 4 2-66 Sheetpile AS/SVE Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$18,432	$92,160	
Overnight shipping to subcontract labs	5	per year	$150	$750	
Groundwater Monitoring labor (5 years)	450	hours	$120	$54,000	assume two people for two 10-hour days each semiannual event, mob and demob and travel time.
SVE monitoring labor (5 years)	120	hours	$120	$14,400	assume one person for one 10-hour day plus travel time each semiannual event
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$800	$8,000	2 events per year for 5 years
				$169,310	Subtotal
Power, O&M, Carbon Replacement					
Power	60	per month	$620	$37,200	based on Calibre cost of $612 per month to run two SVE trailers
O&M labor	720	hours	$120	$86,400	based on 12 hours per month for 60 months
ODCs	5	per year	$1,200	$6,000	based on Calibre ODC of $100/month for SVE systems
Carbon change out	7	Per event	$5,500.00	$38,500	Based on 2-66 DDC IM carbon change out, assume 2 changes per year for the first two years and 1 change per year for the remaining three years
				$168,100	Subtotal
Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
Labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	300	hours	$175	$52,500	60 hours per year for 5 years
	500	hours	$120	$60,000	100 hours per year for 5 years
				$112,500	Subtotal

Estimated Total $879,792

RA 4 2-66 Sheetpile AS/SVE Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs	36	ea	$162	$5,832	Semiannual groundater sampling in all 16 wells (10 AS, 6 shoreline), plus duplicates
VOC in air by TO-15	42	ea	$300	$12,600	sample vapor at 20 SVE wells and after the carbon each semiannual event
TOC	0	ea	$60	$0	
D. Gases	0	ea	$100	$0	
Ferrous iron	0	ea	$40	$0	
Anions	0	ea	$60	$0	
O. acids	0	ea	$140	$0	
PP metals	0	ea	$160	$0	
Bacterial census	0	ea	$300	$0	
				$18,432	Total

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RA 4 2-66 Sheetpile Area Estimated Costs for Soil Excavation to cVOC Leaching SLs

Number of Exceedance Locations 9

Locations	**L**	**W**	**D**	**LF**	**SF**	**CF**	**CY per exc.**	**TONS per exc.**
Exceedance location dimensions	10	10	10	40	100	1,000	40	58

Item	**Qty**	**Cost per Unit**	**2014 Cost**	**2017 Cost**	**Total CY**	**Total tons**
Mobilization/Demobilization (ls)	1	$ 4,000	$ 4,000	$ 4,172	360	522
Concrete cutting (lf)	360	$ 5	$ 1,800	$ 1,877		
Concrete removal (sf)	900	$ 2.50	$ 2,250	$ 2,347		
Concrete disposal (ton)	392	$ 125	$ 48,938	$ 51,042		
Soil excavation (cy)	360	$ 4	$ 1,440	$ 1,502		
Testing (ls)	16	$ 850	$ 13,600	$ 14,185		
Soil disposal (ton)	522	$ 77.86	$ 40,643	$ 42,391		
Backfill hauling (ton)	522	$ 15	$ 7,830	$ 8,167		
Backfill placement (cy)	360	$ 4	$ 1,440	$ 1,502		
Pavement replacement (sf)	900	$ 4	$ 3,600	$ 3,755		
Monitoring (ls)	9.5	$ 1,200	$ 11,400	$ 11,890		
Report (ls)	5	$ 1,920	$ 9,600	$ 10,013		
Subtotal			$ 146,540	$ 152,842		
Contingency (30%)			$ 43,962	$ 45,852		
Total			**$ 190,503**	**$ 198,694**		
		tons:	**522**	**522**		
		$/ton:	**$ 365**	**$ 381**		

	Costs	**Contingency**	**Total**	
Consultant	$ 21,903	$ 6,571	$ 28,474	
Contractor	$ 116,754	$ 35,026	$ 151,780	
Laboratory	$ 14,185	$ 4,255	$ 18,440	
Total	**$ 152,842**	**$ 45,852**	**$ 198,694**	**Estimated Total for cVOC Excavation to Leaching SLs**

Assumptions:

1. Testing includes 40 samples: 22 sidewall, 11 bottom, 5 stockpile, and 2 QA/QC samples.
2. Soil disposal assumes CID rate of $77.86/ton.
3. Monitoring includes 9.5 days of monitoring: 0.5 day preparation, 5 day excavation, and 4 day backfill.
4. Report consists of 3 reports: work plan, sampling plan, and completion report.
5. Monitoring labor is $120/hour for field engineer/scientist.
6. Each exceedance of the FMCL (or leaching SL) is representative of a 10 ft x 10 ft x 10 ft excavation.
7. Total Cost reflects cost adjusted for inflation between October 2014 (draft CMS) and November 2017 (final CMS).

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RA 5 South Yard Area Long Term Monitoring Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$5,896	$29,480	9 property boundary wells
Overnight shipping to subcontract labs	5	per year	$60	$300	
Labor (5 years)	240	hours	$120	$28,800	assume two people for 1 12-hour day each semiannual event
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$100	$1,000	2 events per year for 5 years
				$59,580	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
Labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	140	hours	$175	$24,500	Stand alone report, assumed to cost approx 50% of shoreline reporting costs
	260	hours	$120	$31,200	
				$55,700	Subtotal

Estimated Total $115,280

SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs	18	ea	$162	$2,916	Semiannual sampling in 9 property boundary wells
PP metals	18	ea	$160	$2,880	
PCBs	1	ea	$100	$100	Annual Sampling in 1 property boundary well for 5 years
				$5,896	Total

RA 5 South Yard Area ERD Estimated Costs for CMI

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Initial Sampling					
Work Plan preparation	1	lump sum	$12,000	$12,000	
Utility locate	1	lump sum	$1,000	$1,000	Utility location over a fairly large area
Probe rig (per day)	4	days	$3,500	$14,000	Plume area is approx 400' x 1,200' five narrow transects with 50-ft spacing for a total of 25 points. 7-8 sampling points per day, four days probing.
Sample existing wells	24	hours	$120	$2,880	Sample up to 14 existing A and B level wells in SY Area
Field oversight labor	48	hours	$120	$5,760	four 10-hour days with 2 hours travel time each day
Analytical tests (cVOCs)	55	each	$162	$8,910	50 field samples plus 5 field duplicates
Expenses (equipment, truck, tubing, filters, meters)	1	lump sum	$800	$800	
				$45,350	Subtotal

Remedial Action Planning					
Prepare remediation work plan (includes results from initial sampling)	1	lump sum	$25,000	$25,000	
Labor to assemble equipment/supplies	40	hours	$120	$4,800	
				$29,800	Subtotal

Injection Well Installation					
Utility locate	1	each	$800	$800	
Labor for utility locate oversight	10	hours	$120	$1,200	
Drilling Contractor	18	per well	$3,500	$63,000	Assume 10 4-inch injection wells drilled to 25 ft. bgs, four 4-inch injection wells drilled to 50 ft (costed as two wells each), no additional 2-inch monitoring wells.
Vac truck to clear holes prior to drilling	14	locations	$600	$8,400	$600 per location
Labor for drilling oversight	84	hours	$120	$10,080	4 hours per well for 14 wells plus travel time
Labor for well development	84	hours	$120	$10,080	4 hours per well for 14 wells plus travel time
Well development equipment	14	each	$180	$2,520	submersible pumps and tubing
				$96,080	Subtotal

RA 5 South Yard Area ERD Estimated Costs for CMI

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$14,304	$71,520	10 wells
Overnight shipping to subcontract labs	5	per year	$150	$750	
Labor (5 years)	450	hours	$120	$54,000	assume two people for four 10-hour days each semiannual event, mob and demob and travel time.
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$400	$4,000	2 events per year for 5 years
				$130,270	Subtotal
Injection - follow-up (assume one injection event per year for 5 years)					
Injection equipment	1	lump sum	$3,500	$3,500	one-time purchase
Labor planning	120	hours	$175	$21,000	24 hours per year for 5 years
Labor - injection (assume one person)	425	hours	$120	$51,000	85 hours per year for 5 years including travel time
Sugar	130,000	pounds	$0.85	$110,500	fairly narrow injection area, 26,000 pounds per year for 5 years.
				$186,000	Subtotal

RA 5 South Yard Area ERD Estimated Costs for CMI

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Data Evaluation, Reporting, EPA Meetings and Responses to Comments - Assume 5 years					
Labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	200	hours	$175	$35,000	40 hours per year for 5 years
	400	hours	$120	$48,000	80 hours per year for 5 years
				$83,000	Subtotal

Estimated Total $570,500

SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs	32	ea	$162	$5,184	One event per year sampling all 23 wells, one event per year sampling only the 9 downgradient wells plus duplicates.
TOC	32	ea	$60	$1,920	
D. Gases	9	ea	$100	$900	One event per year in 9 property boundary wells
Ferrous iron	9	ea	$40	$360	
Anions	9	ea	$60	$540	
O. acids	9	ea	$140	$1,260	
PP metals	9	ea	$160	$1,440	
Bacterial census	9	ea	$300	$2,700	
				$14,304	Total

RA 5 South Yard Area ERD and EAD Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Initial Sampling					
Work Plan preparation	1	lump sum	$12,000	$12,000	
Utility locate	1	lump sum	$1,000	$1,000	Utility location over a fairly large area
Probe rig (per day)	4	days	$3,500	$14,000	Plume area is approx 400' x 1,200' five narrow transects with 50-ft spacing for a total of 25 points. 7-8 sampling points per day, four days probing.
Sample existing wells	24	hours	$120	$2,880	Sample up to 14 existing A and B level wells in SY Area
Field oversight labor	48	hours	$120	$5,760	four 10-hour days with 2 hours travel time each day
Analytical tests (cVOCs)	55	each	$162	$8,910	50 field samples plus 5 field duplicates
Expenses (equipment, truck, tubing, filters, meters)	1	lump sum	$800	$800	
				$45,350	Subtotal

Remedial Action Planning					
Prepare remediation work plan (includes results from initial sampling)	1	lump sum	$35,000	$35,000	Work plan is more difficult than for ERD due to EAD
Labor to assemble equipment/supplies	40	hours	$120	$4,800	
				$39,800	Subtotal

Injection Well Installation					
Utility locate	1	each	$800	$800	
Labor for utility locate oversight	10	hours	$120	$1,200	
Drilling Contractor	18	per well	$3,500	$63,000	Assume 10 4-inch injection wells drilled to 25 ft. bgs, four 4-inch injection wells drilled to 50 ft (costed as two wells each), no additional 2-inch monitoring wells.
Vac truck to clear holes prior to drilling	14	locations	$600	$8,400	$600 per location
Labor for drilling oversight	84	hours	$120	$10,080	4 hours per well for 14 wells plus travel time
Labor for well development	84	hours	$120	$10,080	4 hours per well for 14 wells plus travel time
Well development equipment	14	each	$180	$2,520	submersible pumps and tubing
				$96,080	Subtotal

ERD Injection - follow-up (assume one injection event per year for 5 years)					
Injection equipment	1	lump sum	$3,500	$3,500	one-time purchase
Labor planning	120	hours	$175	$21,000	24 hours per year for 5 years
Labor - injection (assume one person)	425	hours	$120	$51,000	85 hours per year for 5 years including travel time
Sugar	130,000	pounds	$0.85	$110,500	fairly narrow injection area, 26,000 pounds per year for 5 years.
				$186,000	

RA 5 South Yard Area ERD and EAD Estimated Costs for CMS

Item	Quantity	Unit	Cost per Unit	Cost	Notes
EAD Probe Injection Costs					
Work Plan preparation	1	lump sum	$10,000	$10,000	
Utility locate	1	lump sum	$800	$800	
Probe rig (per day)	3	days	$3,500	$10,500	7-8 injection points per day, three days probing.
Field oversight labor	48	hours	$120	$5,760	three 10-hour days with 2 hours travel time
Oxygen release substrate	5	each event	$10,000	$50,000	
Expenses (equipment, truck, tubing, filters, meters)	5	lump sum	$400	$2,000	per annual injection event
				$79,060	Subtotal

Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$14,544	$72,720	
Overnight shipping to subcontract labs	5	per year	$300	$1,500	
Labor (5 years)	450	hours	$120	$54,000	assume two people for four 10-hour days each semiannual event, mob and demob and travel time.
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$400	$4,000	2 events per year for 5 years
				$132,220	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
Labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	300	hours	$175	$52,500	60 hours per year for 5 years
	500	hours	$120	$60,000	100 hours per year for 5 years
				$112,500	Subtotal

Estimated Total	**$691,010**

SUPPORTING CALCULATIONS					
Analytical Test Costs					
VOCs	32	ea	$162	$5,184	One event per year sampling all 23 wells, one event per year sampling only the 9 downgradient wells plus duplicates.
TOC	32	ea	$60	$1,920	
DRPH	4	ea	$60	$240	two sampling events per year in two property boundary wells.
D. Gases	9	ea	$100	$900	one event per year in 9 property boundary wells
Ferrous iron	9	ea	$40	$360	
Anions	9	ea	$60	$540	
O. acids	9	ea	$140	$1,260	
PP metals	9	ea	$160	$1,440	
Bacterial census	9	ea	$300	$2,700	
				$14,544	Total

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RA 5 South Yard Area Estimated Costs for Soil Excavation to FMCLs

Number of Exceedance Locations 7

Locations	**L**	**W**	**D**	**LF**	**SF**	**CF**	**CY per exc.**	**TONS per exc.**
Exceedance location dimensions	10	10	3	40	100	300	10	15

Item	**Qty**	**Cost per Unit**	**2014 cost**	**2017 Cost**	**Total CY**	**Total tons**
Mobilization/Demobilization (ls)	1	$ 4,000	$ 4,000	$ 4,172	70	102
Concrete cutting (lf)	280	$ 5	$ 1,400	$ 1,460		
Concrete removal (sf)	700	$ 2.50	$ 1,750	$ 1,825		
Concrete disposal (ton)	237	$ 125	$ 29,604	$ 30,877		
Soil excavation (cy)	70	$ 4	$ 280	$ 292		
Testing (ls)	16	$ 850	$ 13,600	$ 14,185		
Soil disposal (ton)	102	$ 75.50	$ 7,663	$ 7,993		
Backfill hauling (ton)	102	$ 15	$ 1,523	$ 1,588		
Backfill placement (cy)	70	$ 4	$ 280	$ 292		
Pavement replacement (sf)	700	$ 4	$ 2,800	$ 2,920		
Monitoring (ls)	4.0	$ 1,200	$ 4,800	$ 5,006		
Report (ls)	3	$ 1,920	$ 5,760	$ 6,008		
Subtotal			$ 73,460	$ 76,619		
Contingency (30%)			$ 22,038	$ 22,986		
Total			**$ 95,498**	**$ 99,604**		
		tons:	**102**	**102**		
		$/ton:	**$ 941**	**$ 981**		

	Costs	**Contingency**	**Total**
Consultant	$ 11,014	$ 3,304	$ 14,318
Contractor	$ 51,420	$ 15,426	$ 66,846
Laboratory	$ 14,185	$ 4,255	$ 18,440
Total	**$ 76,619**	**$ 22,986**	**$ 99,604**

Estimated Total for Excavation of cVOC to FMCLs	
$ 99,604	**Additional cost for excavation to leaching SLs @ $351 per ton from RA 1**
$ 188,312	

Assumptions:

1. Testing includes 40 samples: 22 sidewall, 11 bottom, 5 stockpile, and 2 QA/QC samples.
2. Soil disposal assumes MTCA rate of $75.50/ton.
3. Monitoring includes 9.5 days of monitoring: 0.5 day preparation, 5 day excavation, and 4 day backfill.
4. Report consists of 3 reports: work plan, sampling plan, and completion report.
5. Monitoring labor is $120/hour for field engineer/scientist.
6. Each exceedance of the FMCL is representative of a 10 ft x 10 ft x 3 ft excavation. Excavation for leaching SL 10 ft x 10 ft x 10 ft
7. Excavation quantity is 70 cy to direct contact cleanup levels and an additional 630 cy for excavation to leaching SL. (17 locations > SLs = 17,000 cubic feet)
8. Total Cost reflects cost adjusted for inflation between October 2014 (draft CMS) and November 2017 (final CMS).

RA 6 Unpaved Shoreline Area Long Term Monitoring Estimated Costs for CMI

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$3,176	$15,880	4 shoreline wells
Overnight shipping to subcontract labs	10	each	$100	$1,000	
EPI labor (5 years)	80	hours	$120	$9,600	assume two people for four hours each semiannual event
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$125	$1,250	Two events per year for five years
				$27,730	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
EPI labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	60	hours	$175	$10,500	6 hours per semiannual event for 5 years
	80	hours	$120	$9,600	8 hours per semiannual event for 5 years
				$20,100	Subtotal

Estimated Total	**$47,830**

SUPPORTING CALCULATIONS

Analytical Test Costs					
VOCs	8	ea	$162	$1,296	Semiannual sampling in four wells
PCBs	6	ea	$100	$600	Annual Sampling in three shoreline wells
PP metals	8	ea	$160	$1,280	Semiannual sampling in four wells
				$3,176	Total

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RA 6 OA 18 Area Estimated Costs for Soil Excavation to FMCLs

Locations	L	W	D	LF	SF	CF	CY	TONS
OA 18 dimensions (Ten exceedances of FMCLs and two of SLs)	210	50	7	520	10500	73,500	2700	3915

Item	Qty	Cost per Unit	2014 Cost	2017 Cost[9]
Mobilization/Demobilization (ls)	1	$ 20,000	$ 20,000	$ 20,860
Remove and replace cover sidewalk	1	$ 90,000	$ 90,000	$ 93,870
Concrete cutting (lf)	520	$ 5	$ 2,600	$ 2,712
Concrete removal (sf)	10500	$ 2.50	$ 26,250	$ 27,379
Concrete disposal (ton)	508	$ 125	$ 63,438	$ 66,165
Soil excavation (cy)	2700	$ 36	$ 97,200	$ 101,380
Testing (ls)	28	$ 850	$ 23,800	$ 24,823
Waste characterization sampling	8	$ 1,000	$ 8,000	$ 8,344
Soil disposal (ton)	3915	$ 75.50	$ 295,583	$ 308,293
Hazardous soil disposal	220	$ 195.00	$ 42,900	$ 44,745
Backfill hauling (ton)	3915	$ 15	$ 58,725	$ 61,250
Backfill placement (cy)	2700	$ 4	$ 10,800	$ 11,264
Pavement replacement (sf)	10500	$ 4	$ 42,000	$ 43,806
Monitoring (ls)	15	$ 1,200	$ 18,000	$ 18,774
Report (ls)	15	$ 1,920	$ 28,800	$ 30,038
Subtotal			$ 828,095	$ 863,703
Contingency (30%)			$ 248,429	$ 259,111
Total			**$ 1,076,524**	**$ 1,122,814**
		tons:	**3,915**	**3,915**
		$/ton:	**$ 275**	**$ 287**

	Costs	Contingency	Total	
Consultant	$ 48,812	$ 14,644	$ 63,456	
Contractor	$ 781,723	$ 234,517	$ 1,016,240	
Laboratory	$ 33,167	$ 9,950	$ 43,118	
Total	**$ 863,703**	**$ 259,111**	**$ 1,122,814**	**Estimated Total for Excavation to FMCLs inclusive of SLs**

Assumptions:

1. Testing includes 28 samples: 10 sidewall, 10 bottom, 6 stockpile, and 2 QA/QC samples.
2. Soil disposal assumes MTCA rate of $75.50/ton.
3. Monitoring includes 12 days of monitoring: 1 day preparation, 10 days excavation, and 4 day backfill.
4. Report consists of 3 reports: work plan, sampling plan, and completion report.
5. Monitoring labor is $120/hour for field engineer/scientist.
6. Average depth of excavation 5 to 7 feet bgs.
7. Hazardous soil estimate from green folder.
8. Excavation quantity is 2,700 cy to direct contact cleanup levels.
9. Total Cost reflects cost adjusted for inflation between October 2014 (draft CMS) and November 2017 (final CMS).

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RA 7 Unpaved Shoreline Area Long Term Monitoring Estimated Costs for CMI

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$3,176	$15,880	4 shoreline wells
Overnight shipping to subcontract labs	10	each	$100	$1,000	
EPI labor (5 years)	80	hours	$120	$9,600	assume two people for four hours each semiannual event
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$125	$1,250	Two events per year for five years
				$27,730	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
EPI labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	60	hours	$175	$10,500	6 hours per semiannual event for 5 years
	80	hours	$120	$9,600	8 hours per semiannual event for 5 years
				$20,100	Subtotal

Estimated Total	**$47,830**

SUPPORTING CALCULATIONS

Analytical Test Costs					
VOCs	8	ea	$162	$1,296	Semiannual sampling in four wells
PCBs	6	ea	$100	$600	Annual Sampling in three shoreline wells
PP metals	8	ea	$160	$1,280	Semiannual sampling in four wells
				$3,176	Total

RA 7 Estimated Costs for Bioventing

Locations	L	W	D	LF	SF	CF	CY	TONS
SWMU 2-10.3A (3 exceedance locations)	40	10	10	100	400	4,000	100	145

Item	Qty	Cost per Unit	2014 Cost	2017 Cost
Mobilization/Demobilization (ls)	1	$ 4,000	$ 4,000	$ 4,172
Install wells and Blower System	1	$ 35,000	$ 35,000	$ 36,505
				$ -
				$ -
				$ -
Testing (ls)	10	$ 850	$ 8,500	$ 8,866
Soil disposal (2 drums)	2	$ 500	$ 1,000	$ 1,043
Backfill hauling (ton)	0	$ 15	$ -	$ -
Backfill placement (cy)	0	$ 4	$ -	$ -
Pavement replacement (sf)	0	$ 4	$ -	$ -
Monitoring (ls)	3	$ 1,200	$ 3,600	$ 3,755
Sampling/O&M	6	$ 1,200	$ 7,200	$ 7,510
Report (ls)	4	$ 1,920	$ 7,680	$ 8,010
Subtotal			$ 66,980	$ 69,860
Contingency (30%)			$ 20,094	$ 20,958
Total			**$ 87,074**	**$ 90,818**
		tons:	**NA**	
		$/ton:	**NA**	

	Costs	Contingency	Total
Consultant	$ 19,275	$ 5,782	$ 25,057
Contractor	$ 41,720	$ 12,516	$ 54,236
Laboratory	$ 8,866	$ 2,660	$ 11,525
Total	**$ 69,860**	**$ 20,958**	**$ 90,818**

Estimated Total for Bioventing to FMCLs

Assumptions:

1. Testing includes 18 samples: 8 sidewall, 3 bottom, 5 stockpile, and 2 QA/QC samples.
2. Total Cost reflects cost adjusted for inflation between October 2014 (draft CMS) and November 2017 (final CMS).

RA 7 Unpaved Shoreline Area Estimated Costs for Soil Excavation to FMCLs

Number of Exceedance Locations 1

Locations	**L**	**W**	**D**	**LF**	**SF**	**CF**	**CY per exc.**	**TONS**
Exceedance location demensions	10	10	10	40	100	1,000	40	58
Item	**Qty**	**Cost per Unit**	**2014 Cost**	**2017 Cost**			**Total CY**	**Total tons**
Mobilization/Demobilization (ls)	1	$ 4,000	$ 4,000	$ 4,172			40	58
Reconstruct stormwater swale	1	$ 50,000	$ 50,000	$ 52,150				
Concrete cutting (lf)	40	$ 5	$ 200	$ 209				
Concrete removal (sf)	100	$ 2.50	$ 250	$ 261				
Concrete disposal (ton)	5	$ 125	$ 604	$ 630				
Soil excavation (cy)	40	$ 4	$ 160	$ 167				
Testing (ls)	6	$ 850	$ 5,100	$ 5,319				
Soil disposal (ton)	58	$ 75.50	$ 4,379	$ 4,567				
Backfill hauling (ton)	58	$ 15	$ 870	$ 907				
Backfill placement (cy)	40	$ 4	$ 160	$ 167				
Pavement replacement (sf)	100	$ 4	$ 400	$ 417				
Monitoring (ls)	2.0	$ 1,200	$ 2,400	$ 2,503				
Report (ls)	3	$ 1,920	$ 5,760	$ 6,008				
Subtotal			$ 74,283	$ 77,477				
Contingency (30%)			$ 22,285	$ 23,243				
Total			**$ 96,568**	**$ 100,721**				
		tons:	**58**	**58**				
		$/ton:	**$ 1,665**	**$ 1,737**				

	Costs	**Contingency**	**Total**	
Consultant	$ 8,511	$ 2,553	$ 11,064	
Contractor	$ 63,647	$ 19,094	$ 82,741	
Laboratory	$ 5,319	$ 1,596	$ 6,915	
Total	**$ 77,477**	**$ 23,243**	**$ 100,721**	**Estimate Total for Excavation to FMCLs**

Assumptions:

1. Testing includes 6 samples: 2 sidewall, 1 bottom, 2 stockpile, and 1 QA/QC samples.
2. Soil disposal assumes MTCA rate of $75.50/ton.
3. Monitoring includes 3.5 days of monitoring: 0.5 day preparation, 2 day excavation, and 1 day backfill.
4. Report consists of 3 reports: work plan, sampling plan, and completion report.
5. Monitoring labor is $120/hour for field engineer/scientist.
6. Each exceedance of the FMCL (or leaching SL) is represenative of a 10 ft x 10 ft x 10 ft excavation.
7. Total Cost reflects cost adjusted for inflation between October 2014 (date of cost estimate for the draft CMS costs) and November 2017 (date of final CMS submittal).

RA 8 Paved Industrial Area Estimated Costs for Soil Excavation to FMCLs

Number of Exceedance Locations 8

Locations	**L**	**W**	**D**	**LF**	**SF**	**CF**	**CY per exc.**	**TONS per exc.**
Exceedance location dimensions	10	10	10	40	100	1,000	40	58
Item	**Qty**	**Cost per Unit**	**2014 Cost**	**2017 Cost**			**Total CY**	**Total tons**
Mobilization/Demobilization (ls)	1	$ 4,000	$ 4,000	$ 4,172			320	464
Concrete cutting (lf)	320	$ 5	$ 1,600	$ 1,669				
Concrete removal (sf)	800	$ 2.50	$ 2,000	$ 2,086				
Concrete disposal (ton)	309	$ 125	$ 38,667	$ 40,329				
Soil excavation (cy)	320	$ 4	$ 1,280	$ 1,335				
Testing (ls)	16	$ 850	$ 13,600	$ 14,185				
Soil disposal (ton)	464	$ 75.50	$ 35,032	$ 36,538				
Backfill hauling (ton)	464	$ 15	$ 6,960	$ 7,259				
Backfill placement (cy)	320	$ 4	$ 1,280	$ 1,335				
Pavement replacement (sf)	800	$ 4	$ 3,200	$ 3,338				
Monitoring (ls)	3.5	$ 1,200	$ 4,200	$ 4,381				
Report (ls)	34	$ 1,920	$ 65,280	$ 68,087				
Subtotal			$ 177,099	$ 184,714				
Contingency (30%)			$ 53,130	$ 55,414				
Total			**$ 230,228**	**$ 240,128**				
		tons:	**464**	**464**				
		$/ton:	**$ 496**	**$ 518**				

	Costs	**Contingency**	**Total**
Consultant	$ 72,468	$ 21,740	$ 94,208
Contractor	$ 98,061	$ 29,418	$ 127,480
Laboratory	$ 14,185	$ 4,255	$ 18,440
Total	**$ 184,714**	**$ 55,414**	**$ 240,128**

$ 240,128	**Estimated Total for Excavation to FMCLs**
$ 81,432	**Cost for additional (160 cy) excavation to leaching SLs @ $351 per ton from RA 1**

Assumptions:

1. Testing includes 16 samples: 8 sidewall, 3 bottom, 4 stockpile, and 1 QA/QC samples.
2. Soil disposal assumes MTCA rate of $75.50/ton.
3. Monitoring includes 3.5 days of monitoring: 0.5 day preparation, 2 day excavation, and 1 day backfill.
4. Report consists of 3 reports: work plan, sampling plan, and completion report.
5. Monitoring labor is $120/hour for field engineer/scientist.
6. Each exceedance of the FMCL (or leaching SL) is representative of a 10 ft x 10 ft x 10 ft excavation.
7. Total Cost reflects cost adjusted for inflation between October 2014 (draft CMS) and November 2017 (final CMS).

RA 9 OA-11 Area Long-Term Monitoring Estimated Costs for CMI

Item	Quantity	Unit	Cost per Unit	Cost	Notes
Sampling and Analytical					
Analytical tests for semiannual GW samples	5	per year	$2,132	$10,660	1 property boundary well and 2 shoreline wells
Overnight shipping to subcontract labs	10	each	$50	$500	
EPI labor (5 years)	40	hours	$120	$4,800	assume two people for two hours each semiannual event
Expenses (equipment, truck, tubing, filters, meters)	10	per event	$125	$1,250	Two events per year for five years
				$17,210	Subtotal

Data Evaluation, Reporting, EPA Meetings and Responses to Comments					
EPI labor: data evaluation, logistical support, meeting support, response to EPA comments, preparation of semi-annual reports.	40	hours	$175	$7,000	4 hours per semiannual event for 5 years
	40	hours	$120	$4,800	4 hours per semiannual event for 5 years
				$11,800	Subtotal

Estimated Total	**$29,010**

SUPPORTING CALCULATIONS

Analytical Test Costs					
VOCs	6	ea	$162	$972	Semiannual sampling in three wells
PCBs	2	ea	$100	$200	Annual Sampling in two wells
PP metals	6	ea	$160	$960	Semiannual sampling in three wells
				$2,132	Total